Clones No 1333 of *Populus alba* × *P. davidiana* and No 1132 of *P. davidiana* × *P. alba* × *P. daviana*

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Abstract The hybridization experiment was initiated in 1975, in which the parents of *P. davidiana* were collected from Dailing, Heilongjiang Province, *P. suaveolens* were from Baicheng, *P. simonii* from Zhaodong of Heilongjiang Province, and *P. tremula* from Shanxi Province. Clones No 1333 of *P. Alba* × *P. davidiana* and No 1132 of *P. davidiana* × *(P. alba* × *P. davidiana* F1) had greater genetic variation and heritability in clones tested.
Key words: Clones, Hybridization, Aspen

Introduction

Aspen(*Populus davidiana* Dode) is a pioneering species which is widely distributed, well adapted, and has good quality of timber. It distributes from Ximalaya Mountains, to Daxing'an Mountains and Xiaoxing'an Mountains and from Artai Mountains to Wusulijiang river, covering 23 provinces of China. Usually it is not limited by soil condition and can adapt variable ecological conditions. It can also grow in either drought site or fertile soil, either plain or alpine. It has ever consistent in the wood structure, less diameter of fibre than the other poplar, but longer in length. It can regenerate from seeds or root- sucker.

However, aspen was not fully used for afforestation in the past because it grows slow and has low survival rate or stocking percentage before selection. It is difficult for vagetative propagation and easy to get wood core decayed. Therefore, on the basis of selection, we stress on hybridization of aspen so as to solve relevant technical problem for aspen development and find a way of developing poplar from plain to mountain.

Material and Method

Populus davidiana parents were collected from Dailing, Heilongjiang Province, *P. alba* and *P. russkii* from Baicheng, *P. simonii* from Zhaozhou, F1 of *P. simonii* × *P. nigra* from Harbin, *P. nigra* var *thevestina* from Shanxi Province. F1 of *P. alba* × *P. davidiana* were planted in 1962.

By means of water culture of cutting for controlled pollination, F1 of *P. alba* × *P. davidiana*, *P. davidiana* × *(P. alba* × *P. davidiana* F1), *P. simonii* × *(P. alba* × *P. davidana* F1), *P. davidana* × *(P. simonii* × *P. nigra* F1), *P. davidiana* × *P. russkii*, *P. nigra* var. *thevestina* × *P. davidiana* were planted in Shuangcheng, Hulan, and Zhaodong counties of Heilongjiang Province in 1975 or 1976, spaced by 2 m × 2 m,. replicated 3 times. Clones of superior hybrids after selection were planted in Shuangchen, Jiangshanjiao, Dongfanghong, Renchun, Zhaodong counties in Heilongjiang, Jilin, Shanxi Provinces, replicated 5-6 times.

This paper was based on the data from Shuangchen, Heilongjiang, in 1990.

Results

Analysis of variance of hybrid combination and LSD test

From the results of ANOVA (Table 1), the differences between hybrids in the DBH, height and volume of hybrid combination are significant. LSD multiple comparison test between pairs of hybrids are listed in Table 2. The difference between the DBH of *P. alba* × *P. davidiana* (AD), *P. davidiana* × (*P. alba* × *P. davidiana* F1) (DAD), *P. simonii* × (*P. alba* × *P. davidiana* F1) (SAD), *P. davidiana* × *P. russkii* (DR) have no significance. But they have significent difference, compared

with *P. davidiana* × (*P. simonii* × *P. nigra*) (DSN), *P. nigra* var. *thevestina* × *P. davidiana* (NTD) (Table 2).

Table 1. Analysis of variance for the growth of hybrid combination

Traits	source	D.F.	S.S.	M.S.	F- values	
DBH	Varieties	5	160.11	32.02	3.507*	F(0.05)=2.71
	Replication	4	48.19	12.05		F(0.01)=4.10
	error	20	182.52	9.13		
Height	Varieties	5	70.34	14.07	4.88*	
	Replication	4	23.03	5.76		
	error	20	57.52	2.88		
Volume	Varieties	5	0.06319	0.01264	4.498**	
	Replication	4	0.01729	0.00432		
	error	20	0.05627	0.0281		

Notes:** stands for significance at 0.01 level; * significance at 0.05 level.

Table 2. LSD test for the DBH of hybrid combination

Hybrid combination		AD	DAD	SAD	DR	DSN	NTD
	DBH(cm)	19.00	17.99	16.98	16.74	14.45	12.08
AD	19.00		1.01	2.02	2.26	4.55*	6.92**
DAD	17.99			1.01	1.25	3.54	5.91**
SAD	16.98				0.24	2.53	4.90*
DR	16.74					2.19	4.66*
DSN	14.45						2.37
NTD	12.08						

Notes:**stands for significance at 0.01 level; * significance at 0.05 level.

Table 3 shows LSD test for the height of hybrid matches. The difference between the growth of height of *P. alba* × *P. davidiana* (AD), *P. davidiana* × *(P. alba* × *P. davidiana* F1) (DAD), *P.simonii* × *(P. alba* × *P. Davidiana* F1*)* (SAD), *P. davidiana* × *P. russkii* (DR) have no significance. But they have very significent difference, compared with *P. davidiana* × *(P. simonii* × *P. nigra)* (DSN), *P. nigra* var. *Thevestina* × *P. davidiana* (NTD).

Table 3. LSD test for the height of hybrid combination

Hybrid combination		AD	DAD	SAD	DR	DSN	NTD
	Height(m)	16.6	15.37	15.12	14.53	14.14	11.16
AD	16.6		1.23	1.48	2.07	2.46*	5.44**
DAD	15.37			0.25	0.84	1.23	4.21**
SAD	15.12				0.59	0.98	3.96**
DR	14.53					0.39	3.37**
DSN	14.14						2.98
NTD	11.16						

Notes:**stands for significance at 0.01 level; * significance at 0.05 level.

P. alba × *P. davidiana* and *P. davidiana* × *P. alba* × *P. davidiana* were selected as superior hybrids after comprehensive survey on morphology, quality, cold- resistence, and C. V. of growth, for example, standard error of diameter of *P. alba* × *P.davidiana* is 1.22, *P. davidiana* × *P. alba* × *P. davidiana* is 1.55, C.V. of *P. alba* × *P. davidiana* is 6.4. *P. davidiana* × *P. alba* × *P. davidiana* is 1.34. All of them are less than the others.

Selection for superior clone

As mentioned above, *P. alba* × *P. davidiana* and *P. davidiana* × (*P. alba* × *P. davidiana* F1) were selected as superior hybrids. 6 clones and 5 clones were selected from both of them, respectively. ANOVA for two years old seedling shows in Table 4. These clones have got high significant difference in height and collar diameter.

From the results of LSR multiple comparison for Aspen hybrid clones (Table 5, 6), clones No.1333 of *P. alba* × *P. davidiana* and No. 1132 of *P. davidiana* × *P. alba* × *P. davidiana* have great significant difference at 0.01 level. So they are selected as superior clones.

Table 4. Analysis of variance the collar diameter and height of aspen hybrids clones

hybrid closes		DF	MS value of D	MS value of H
P. alba × *P. davidiana*	Varieties	5	0.6140**	0.2770**
	Replication	4	0.0439	0.013
	error	20	0.1364	0.00509
P. davidiana × *P. alba*× *P. davidiana*	Varieties	4	0.13916**	0.2345**
	Replication	4	0.0170	0.012
	error	16	0.0133	0.0416

Notes:** significance at 0.01 level; * significance at 0.05 level.

Table 5. LSR test for the collar diameter and height of clones of *P. alba* × *P. davidiana*

	No of clones	mean	0.05 level	0.01 level
	1333	1.9	a	A
D	1433	1.59	a	A
	1534	1.45	a b	A
	1635	1.32	b	A B
	1733	1.12	b c	B
	1834	0.91	c	B
H	1333	1.73	a	A
	1433	1.59	b	B
	1534	1.49	c d	B C
	1635	1.38	d	C D
	1733	1.26	e	D
	1834	1.08	f	E

The genetic parameters of clonal traits of *P. alba* × *P. davidiana* and *P. davidiana* × *P. alba* × *P. davidiana*

were estimated in Table 7 and 8.

Table 6. LSR test for the collar diameter and height of clones of *P. davidiana* × *P. alba* × *P. davidiana*

	No of clones	mean	0.05 level	0.01 level
	1132	1.7986	a	A
D	1135	1.4580	b	B
	1031	1.2630	c	B
	1035	1.0532	d	C
	0930	0.8164	e	D
H	1132	1.6564	a	A
	1135	1.5478	b	A B
	1031	1.4494	c	B
	1035	1.3438	d	C
	0930	1.0902	e	D

Table 7. Genetic parameters of clonal traits of *P. alba* × *P. davidiana*

Genetic parameter	D	H
Mean phenotypic value	1.38	1.42
Mean range	0.68-2.00	0.88-1.82
Genetic variance	0.09552	0.05438
Environmental variance	0.1364	0.00509
Phenotypic variance	0.23192	0.14798
General heritability	77.79	98.16
Genetic C. V.	0.2236	0.1642
Phenotypic C. V.	0.3485	0.1717

Discussion

In clonal test, clone No 1333 of *P. alba* × *P. davidiana* and No 1132 of *P. davidiana* × *P. alba* × *P. davidiana* have greater genetic variance and heritability in Diameter and Height. They are improved after selection.

The volume of *P. alba* × *P. davidiana* 1333 and *P. davidiana* × *P. alba* × *P. davidiana* are over 2 times than that of control during seedling and 1 times that of control in the middle age of tree. They have also the same character of wood as control.

Table 8. Genetic parameters of clonal traits of *P. davidiana* × *P. alba* × *P. davidiana*

Genetic parameter	D	H
Mean phenotypic value	1.28	1.42
Mean range	0.55-1.96	0.96-1.72
Genetic variance	0.13916	0.04621
Environmental variance	0.01333	0.00346
Phenotypic variance	0.15246	0.04967
General heritability	91.12	98.52
Genetic C. V.	0.06527	0.1517
Phenotypic C. V.	0.06589	0.1572

Two selected clones have close juvenile -mature correlation. It is predicted that they have the same the characters of cold-resistance and fast-growth as their parents.

References

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